REMARKS

The Office Action has been carefully reviewed. Reconsideration and allowance of the claims in light of the foregoing amendments and request for continued examination under 37 C.F.R. 1.114 is respectfully requested. In addition, a petition and fee for a three-month extension accompanies this response.

Applicant's 12/12/05 Amendment, which amended the specification, submitted a replacement drawing for Fig. 1, amended claims 1, 8, and 25-28, canceled claims 2-7, 12-17, 20 and 22-24, and traversed the rejection of claims in the 7/27/04 Office action, was acknowledged by the Office Action.

Applicant's amendment further limited the claims in order to define over the applied art in the 7/27/04 Office action. The previous claim 1, for example, which recited "a core comprising a fissile metal hydride" has been further limited to "a core consisting essentially of a powdered fissile metal hydride. Whereas the previous claim is directed to a generic metal hydride, i.e., no specific physical form of the hydride, the amended claim is now specific that the hydride is of powder form.

The current examiner agreed that the amended claims overcome the rejection based on the applied art in the 7/27/04 Office action. However, they still do not defied over other prior art.

Additionally, the amended claims now recite a particular species of fissile metal hydride, i.e. powdered form, which raises a lack of an operative embodiment issue under 35 U.S.C. 101. The amendment also raises an issue under 35 U.S.C. 112, first paragraph, since the claimed invention to the powdered species is not supported by a well established utility and one skilled in the art clearly would not know how to use the claimed invention.

The specification was objected to under 35 U.S.C. 112, first paragraph, as failing to provide an adequate written description of the invention, i.e., failing to provide an enabling disclosure.

The Office Action stated that as presently set forth in the amended claims, the invention was directed to a nuclear reactor having a core consisting essentially of a powdered fissile metal hydride. The Office Action further stated that the disclosure was insufficient in failing to set forth, operative embodiments or examples of the invention, including parameters, such as the ratio of fissile to non-fissile material, required purity of

the hydrogen atmosphere, fissile material and non fissile material, surface area-to-volume requirement for the reactor, etc.

The Office Action argued that the applicant himself admits to said lack of operative embodiment as evidenced, for example, by the following statements in the specification:

- "While MCNP was used to evaluate the critical mass of the reactor configurations, these calculations were verified using the following scientific literature. H.C. Paxton et al., "Critical Dimensions of Systems Containing U^{235}, PU^{239}, U^{233}, Los Alamos Scientific Laboratory Report TID-7028 (June 1964), have complied extensive data on uranium criticality, mostly from experiments using highly enriched uranium diluted with water moderator. (underlining provided). See page 14, lines 16+.

- "The "C: curve for 4.9% enriched uranium is most appropriate for estimating the critical mass for this device. The line from 15 kg past 30 kg has been extrapolated from the published data and the critical mass for the hydride power source can be estimated from this extrapolation to be approximately 30 kg of U^{235} for the H to U^{235} ratio of 61, which is characteristic of UH_3 enriched to 4.9%. This value is approximately double the critical mass measured for 93% enriched uranium hydride: G.A. Linenberger, et al., "Enriched-Uranium Hydride Critical Assemblies, " Nuclear Science and Engineering: 7, 44-57 (1960).

  The experiments by Linenberger, et al., were performed on blocks of UH_3 that were fabricated from powdered UH_3 held together with a polymeric binder. Since the powder was bound with the polymer, no experiments could be performed to investigate the self-stabilizing potential of the UH_3 powder, active material." (underling provided). See page 15, lines 18+.

- "The physical dimensions of a practical device will depend on many important engineering factors and can be purposely manipulated in may ways. (Underlining provided). See page 21, lines 15+.

- "It is anticipated that a compact reactor according to this invention will be assembled and fueled at a factory and shipped to its installation point as a sealed unit." (Underling provided). See page 21, lines 15+.

The Office Action further argued that clearly, applicant himself admits that no experiments with a powdered hydride were conducted to validate the results of calculations, extrapolations, etc. that were performed using non-powdered metal hydride data. Applicant also has not identified the many important engineering factors to be considered before a practical device can be built. Applicant's statement on

"anticipated" compact reactor is clear evidence that such reactor is, at best, still being planned and has not been realized.

The Office Action argued further that there is no evidence to indicate that the applicant has arrived at an operative system, i.e., that he has progressed his system beyond the point of an unproven theory or concept which still requires an undue amount of experimentation to enable the artisan to make and use the inventive system for its indicated purpose. This view is also considered supported by the failure to set forth a full example of the specific parameters of an operative embodiment. One cannot rely on the skill in the art for the selection of the proper quantitative values to present an operative system, since those in the art do not know what would be these values. See Bank v. Rauland Corp., 64 U.S.P.Q. 93; In re Corneil et al., 145 U.S.P.Q. 697.

The Office Action concluded that it was thus considered that the examiner (for the reasons set forth above) has set forth a reasonable and sufficient basis for challenging the adequacy of the disclosure. The statute requires the applicant itself to inform, not to direct others to find out for themselves; In re Gardner et al, 166 U.S.P.Q. 138, In re Scarborough, 182 U.S.P.Q. 298. Note that the disclosure must enable a person skilled in the art to practice the invention without having to design structure not shown to be readily available in the art; In re Hirsch, 131 U.S.P.Q. 198.

Applicant submits that a specification is enabling if it teaches one of ordinary skill in the art to make or use the invention without undue experimentation. The Examiner must show that undue experimentation would be required to make and use the invention. In re Angstadt 537 F.2d 489, 190 USPQ 214 (C.C.P.A. 1976). Accordingly, Applicant submits that the Examiner has failed to meet the burden of showing that undue experimentation would be required to make and use the invention.

On page 3 of the March 20 Final Office Action, the Examiner states: "[t]he disclosure is insufficient in failing to set forth, operative embodiments or examples of the invention, including parameters, such as the ratio of fissile to non-fissile material, required purity of the hydrogen atmosphere, fissile material and non-fissile material, surface area-to-volume requirement for the reactor, etc."

Regarding the failure "to set forth, operative embodiments or examples of the invention," applicant submits that there is no requirement that a specification include a working example of the invention if the invention is otherwise disclosed in such a

manner that one skilled in the art would be able to practice the invention without undue experimentation. See, for example, In re Borkowski 422 F.2d 904, 164 USPQ 642 (C.C.P.A. 1970), and Lawson v. Bruce, 222 F.2d 273, 278, 105 USPQ 440 (C.C.P.A. 1955). Thus, by relying on the absence of examples in the specification, the Examiner has not met his burden of showing that the specification is not enabling.

Regarding the Examiner's statement that "[t]he disclosure is insufficient in failing to set forth,[sic] operative embodiments...including parameters, such as the ratio of fissile to non-fissile material...", applicant submits that the specification, on page 5, lines 20-23, states that "reactor grade fuel" consists of 5% fissile U-235 hydride and 95% non-fissile U-238 hydride. In addition, Table 1, found on page 6 of the specification, provides fissile material enrichment levels of the hydride that would be necessary for nuclear criticality to occur under different conditions. The enrichment levels shown in Table 1 were determined using a Monte Carlo neutron transport code. Such transport codes are routinely used by those skilled in the art to predict the amount of fuel needed to achieve a critical mass.

Regarding the Examiner's statement that "[t]he disclosure is insufficient in failing to set forth,[sic] operative embodiments...including parameters, such as...required purity of the hydrogen atmosphere, (and) fissile material and non-fissile material...," applicant submits that the Examiner has not met his burden of showing one of ordinary skill in the art would have to undertake undue experimentation to determine these parameters. Applicant submits that Applicant asserts that one of ordinary skill in the art would know what purity levels of the hydrogen atmosphere, fissile material, and non-fissile materials are acceptable. That which is obvious to a person of ordinary skill in the art need not be expressly stated in the application. Standard Oil v. Montedison S.p.A, 664 F.2d 356, 212 USPQ 327, 343 (3d. cir. 1981) (citing in re Hafner, 410 F.2d 1403, 1406, 161 USPQ 783, 785-85 (CCPA 1969). Burke (U.S. Patent 3,156,747), for example, in column 2, lines 53-54, refers to "finely divided pure uranium" but does not provide a specific level of purity. Applicant submits that this statement by the reference serves as an acknowledgement that one of ordinary skill in the art would know the required purity of the different materials or could determine the required purity without undue experimentation. Furthermore, the specification of the instant application, on page 7, lines 4-19, cites references, dating back to 1949, that describe the formation of

metal hydrides and the use of uranium hydrides in critical assemblies. Applicant submits that, given that that uranium hydride and its use in critical assemblies and nuclear reactor applications has been studied for almost 60 years, one of ordinary skill in the art would know – or could determine without undue experimentation – what the requisite purity levels of these materials are.

Regarding the Examiner's statement that "[t]he disclosure is insufficient in failing to set forth,[sic] operative embodiments...including parameters, such as...surface area-to-volume requirement for the reactor, etc.," applicant submits that the Examiner has not met his burden of showing one of ordinary skill in the art would have to undertake undue experimentation to determine these parameters. That which is obvious to a person of ordinary skill in the art need not be expressly stated in the application. Standard Oil v. Montedison, S.p.A 212 USPQ at 343. Accordingly, applicant submits that one of ordinary skill in the art could determine the surface area-to-volume requirement for the reactor without undue experimentation. For example, Von Ohain et al. (U.S. Patent 3,618,322), cited by the Examiner, teaches a cavity reactor in which a critical quantity of fissionable powdered material is admitted into a cavity C. See, for example, the Abstract and column 1, lines 59-69, of the reference. Von Ohain et al. do not provide a surface area-to-volume requirement for the reactor. Applicant submits that the omission of the surface area-to-volume requirement by the reference serves as an acknowledgement that one of ordinary skill in the art would either know the surface area-to-volume requirements for a reactor or could determine this parameter without undue experimentation.

The Examiner further states: "applicant himself admits that no experiments with a powdered hydride were conducted to validate the results of calculations; extrapolations, etc. that were performed using non-powdered metal hydride data. Applicant also has not identified the many important engineering factors to be considered before a practical device can be built. Applicant's statement on [an] 'anticipated' compact reactor is clear evidence that such reactor is, at best, still being planned and has not been realized."

Applicant submits that 35 U.S.C. §112, first paragraph, does not require that the specification contain a working example if the invention is otherwise disclosed in such a manner that one skilled in the art would be able to practice the invention without undue experimentation. In re Borkowski, 164 USPQ at 645. Moreover, an applicant need not

have actually reduced the invention to practice prior to filing the invention. See Gould v. Quigg, 822 F.2d 1074, 1078, 3 USPQ 2d 1302, 1304 (Fed. Cir. 1987). Accordingly, the Examiner's statements regarding the lack of experiments with a powdered hydride and that the reactor is still being planned and has not been realized are insufficient to raise an objection or rejection under 35 U.S.C. §112, first paragraph; applicant is not required to either provide a working example or reduce the reactor to actual practice.

As previously presented, it is the applicant's position that the "many important engineering factors" identified by the Examiner – i.e., "parameters, such as the ratio of fissile to non-fissile material, required purity of the hydrogen atmosphere, fissile material and non-fissile material, surface area-to-volume requirement for the reactor, etc." taught by the present invention may be practiced by those skilled in the art without undue experimentation. Thus, the need to provide working examples is obviated by the sufficiency of the disclosure.

Applicant therefore submits that, because: 1) the Examiner has not met his burden of showing one of ordinary skill in the art would have to undertake undue experimentation; 2) certain "engineering factors" described above could be determined by those of ordinary skill in the art without undue experimentation; and 3) the need to provide working examples is obviated by the sufficiency of the disclosure, the objection to the specification under 35 U.S.C. §112, first paragraph, is successfully overcome.

Claims 1, 8, 18, 19, 21 and 25-28 stand rejected under 35 U.S.C. 101 because the disclosed invention is inoperative and therefore lacks utility.

The Office Action stated that the reasons that the invention as disclosed is inoperative are the same as the reasons set forth in the objection to the specification, which were described above.

The Office Action concluded that the applicant at best, has set forth what may be considered a concept or an object of scientific research for the indicated species of powdered metal hydride. However, it has been held that such does not present a utility with in the meaning of 35 U.S.C. 101. See Brenner v. Manson, 148 U.S.P.Q. 689.

Additionally, it is well established that whereas here, the utility of the claimed invention is based upon allegations that border on the incredible or allegations that would not be readily accepted by a substantial portion of the scientific community, sufficient substantiating evidence of operability must be submitted by applicant. Note In

re Houghton, 167 U.S.P.Q. 687 (CCPA 1970); In re Ferens, 163 U.S.P.Q. 609 (CCPA 1969); Puharich v. Brenner, 162 (U.S.P.Q. 146 (CA DC 1969); In re Pottier, 152 U.S.P.Q 407 (CCPA 1967); In re Ruskin, 148 U.S.P.Q. 221 (CCPA 1966); In re Citron, 139 U.S.P. Q. 516 (CCPA 1963); and In re Novak, 134 U.S.P.Q. 335 (CCPA 1962).

Applicant submits that, as presented above, the specification provides sufficient enablement to enable one of ordinary skill in the art to make and use the invention without undue experimentation, and that the present invention as claimed is therefore operative. Because the invention as described is operative, one of ordinary skill of the art would readily recognize the utility of the invention. In addition, applicant submits that the utility of the invention is established in the specification. See, for example, the page 4, lines 14-20, of the specification.

Applicant submits that, because the invention as disclosed is operative and has a stated utility, the rejection of Claims 1, 8, 18, 19, 21, and 25-28 under 35 U.S.C. §101 is successfully overcome.

Claims 1, 8, 18, 19, 21 and 25-28 further stand rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

The Office Action stated that the reasons that the invention as disclosed is not enabling is for the same as the reasons set forth above as to why the specification is objected to and the reasons set forth above are accordingly incorporated herein.

Applicant submits that the specification is enabling as it teaches one of ordinary skill in the art to make or use the invention without undue experimentation. The Examiner must show that undue experimentation would be required to make and use the invention. In re Angstadt 537 F.2d 489, 190 USPQ 214 (C.C.P.A. 1976). Accordingly, Applicant submits that the Examiner has failed to meet the burden of showing that undue experimentation would be required to make and use the invention. Further, applicant has set out above in response to the objection to the specification, why the specification is enabling for one skilled in the art to make and use the invention and these arguments apply similarly to the rejection of these claims. Rejection of the claims under 35 U.S.C. 112, first paragraph, is urged to be withdrawn.

Claims 1, 8, 18, 19, 21 and 25-28 stand rejected under 35 U.S.C.103(a) as being unpatentable over von Ohain et al. (U.S. 3,618,322) in view of Burke (U.S. 3,156,747). The Office Action stated that von Ohain et al. disclose the applicant's claims except for the metal hydride. Further, the Office Action stated that von Ohain et al. teach a nuclear reactor having a core of fissionable material in a powdered state that is exposed to a stream of gaseous hydrogen (see Figs. 1 and 2, and col. 1, lines 62+).

Still further, the Office Action stated that Burke teaches compacts for neutronic systems, which compacts include a predetermined ratio of hydrogen to metals such as uranium, plutonium and their compounds. He states that combinations of hydrogen and uranium have become of great importance because hydrogenous material is effective in slowing down neutrons to an energy at which uranium has a large cross section. He further highlights uranium hydride to be an optimum combination of uranium and hydrogen because it furnishes considerably higher densities that other combinations (see col. 1, lines 10+). Since no neutronic system utilizes 100% enriched uranium, Burke's uranium hydride inherently includes both fissile U^{235} along with some non-fissile U^{238}.

The Office Action noted that von Ohain et al. teach the use of a fissionable material for a nuclear reactor and the compacts that Burke teach are for specific use in neutronic systems that include nuclear reactors. Thus, both references are in the same field of endeavor.

Therefore, the Office Action concluded that it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the apparatus, as disclosed by von Ohain et al., by the teaching of Burke, to use uranium hydride for the fissionable material, to gain the advantages thereof (i.e., higher density and more compact reactor system), because such modification is no more that the use of a well-known nuclear fuel material within the nuclear art.

The Office Action further explained that applicant's claim language reads on the von Ohain et al.-Burke apparatus as follows (see Figs. 1-3 in von Ohain et al.)" a) "powdered fissile material" reads on the fissile U^{235} material inside the reactor cavity C (see col. 2, lines 5+); b) "non-fissle U^{238} material outside the reactor cavity C, e.g., in separator 20, i.e., for claim 1 and/or claim 19 (see col. 3, lines 3+); c) "means for controlling the non-fissile material temperature" reads on additional hydrogen gas

admitted into the separator through slots 32, to reduce the wall temperature of the separator (see col. 3, lines 37+); d) "plurality of trays holding non-fissile material" reads on the two separators 20 in the emodiment shown in Fig. 3.

Applicant submits that the invention of claim 1 is directed to a nuclear fission reactor, such a reactor including a core consisting essentially of a powdered fissile metal hydride, an atmosphere comprising a hydrogen isotope to which said powdered fissile metal hydride is exposed, a non-fissile material positioned separate from said core where said non-fissile material absorbs and desorbs said hydrogen isotope based on temperature and means for controlling said non-fissile material temperature. Applicants have amended the prior claim 1 to clarify that the non-fissile material is positioned separate from the core as shown in Fig. 1 wherein the powdered fissile metal hydride is shown at 18 and the non-fissile material for absorbing and desorbing the hydrogen isotope based on temperature is shown positioned separate at 24. Applicant submits that neither von Ohain nor Burke teach or suggest a core of a powdered fissile metal hydride in combination with a non-fissile material positioned separate from the core where the non-fissile material absorbs and desorbs said hydrogen isotope based on temperature. Together with the hydrogen atmosphere of a hydrogen isotope to which the powdered fissile metal hydride is exposed and the means for controlling the non-fissile material temperature, the invention of claim 1 provides a nuclear fission reactor that is based on and takes advantage of the physical properties of a fissile metal hydride which serves as a combination fuel and moderator. The reactor of the invention can be described as self-stabilizing and requires no moving mechanical components to control nuclear criticality. The control of the nuclear activity is achieved through the temperature driven mobility of the hydrogen isotope contained in the hydride. If the core temperature increases beyond a set point, the hydrogen isotope dissociates from the hydride and escapes out of the core, the moderation drops and the power production decreases. If the temperature drops, the hydrogen isotope is again associated with the fissile material hydride and the process is reversed, i.e., the power production increases.

The combination of von Ohain and Burke simply fails to teach or suggest the presently claimed invention as von Ohain requires a separator to capture and return nuclear material from the core and return such nuclear material to the reactor cavity. As

von Ohain is essentially a reactor design referred to as a Rover reactor for production of an output stream of heated expellant gas (hydrogen) for a space propulsion system. Burke is directed to fuel compacts and especially to uranium hydride fuel compacts. But despite the assertions of the Office Action that Burke's uranium hydride inherently includes both fissile U^{235} and non-fissile U^{238}, this assertion does not yield the presently claimed invention wherein a non-fissile material is deliberately positioned separate from the core (whereat the fissile material resides) for interaction with the hydrogen gas through absorption and desorption. Only in the present application is a system provided that uses the temperature of the system to control the absorption and desorption of hydrogen isotope from the non-fissile material such as non-fissile uranium hydride. Accordingly, withdrawal of the rejection of claims 1, 8, 18, 19, 21 and 25-28 over von Ohain in view of Burke is urged.

In view of the foregoing amendments and remarks, claims 1, 8, 18, 19, 21 and 25-28 are urged to be allowable over 35 U.S.C. 101, 103 and 112. If the Examiner believes there are any unresolved issues despite this amendment, the Examiner is urged to contact the applicants' attorney undersigned below for a telephonic interview to resolve any such issue. A favorable action is solicited.

Respectfully submitted,

Date: 9/27/2006

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